

[Total Marks 30]

1. Sort a random array of n integers (accept the value of n from user) in ascending order by using bubble sort algorithm.
 - Accept & Display Function [10]
 - Bubble Sort Function [5]

2. Write a C program which uses Binary search tree library and implements following Functions:
 - Create Binary search Tree [10]
 - Insert a node in a binary search tree [10]
 - Display a binary search tree(In order Traversal) [5]

OR

Q.1) Data Structures Using 'C'

1. A postfix expression of the form $ab+cd-*ab/$ is to be evaluated after accepting the values of a, b, c and d. The value should be accepted only once and the same value is to be used for repeated occurrence of same symbol in the expression. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Define a class Message with two data members one character pointer and an integer storing length. Implement following functions:
 - a) Default constructor and Parameterized constructor [2+3]
 - b) Overload binary + operator to represent concatenation of messages [7]
 - c) Overload [] operator to return a character at a specific position [8]
 - d) Overload = operator to copy one Message object to another. [5]Write a main function that uses the above class and its member functions. [5]

OR

2. Implement a class 'data' to overload following functions as follows:
 - a) int maximum(int, int) – returns the maximum between the two integer arguments [2]
 - b) int maximum(int *a, int arraylength) – returns the maximum integer from an array 'a' [5]
 - c) void maximum(int *a, int arraylength, int n) – display all elements from the array 'a' which are greater than given number 'n'. [5]
 - d) int minimum(int, int) – returns the minimum between the two integer arguments [2]
 - e) int minimum(int *, int arraylength) – returns the minimum integer from an array 'a' [5]
 - f) void minimum(int *a, int arraylength, int n) –display all elements from the array 'a' which are smaller than given number 'n'. [5]Write a main function that uses the above class and its member functions. [6]

Q.3) Viva

[10]

[Total Marks 30]

1. Sort a random array of n integers (accept the value of n from user) in ascending order by using bubble sort algorithm.
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Q.3) Viva

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OR

Q.1) Data Structures Using 'C'

1. A postfix expression of the form $ab+cd-*ab/$ is to be evaluated after accepting the values of a, b, c and d. The value should be accepted only once and the same value is to be used for repeated occurrence of same symbol in the expression. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

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Write a main function that uses the above class and its member functions. [5]

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2. Implement a class 'data' to overload following functions as follows:

- a) $\text{int maximum}(\text{int}, \text{int})$ – returns the maximum between the two integer arguments [2]
- b) $\text{int maximum}(\text{int} *a, \text{int arraylength})$ – returns the maximum integer from an array 'a' [5]
- c) $\text{void maximum}(\text{int} *a, \text{int arraylength}, \text{int n})$ – display all elements from the array 'a' which are greater than given number 'n'. [5]
- d) $\text{int minimum}(\text{int}, \text{int})$ – returns the minimum between the two integer arguments [2]
- e) $\text{int minimum}(\text{int} *, \text{int arraylength})$ – returns the minimum integer from an array 'a' [5]
- f) $\text{void minimum}(\text{int} *a, \text{int arraylength}, \text{int n})$ –display all elements from the array 'a' which are smaller than given number 'n'. [5]

Write a main function that uses the above class and its member functions. [6]

Q.3) Viva

[10]

1. Sort a random array of n integers (accept the value of n from user) in ascending order by using insertion sort algorithm.
 - Accept & Display Function [10]
 - Insertion Sort Function [5]

2. There are lists where insertion should ensure the ordering of data elements. Since the elements are in ascending order the search can terminate once equal or greater element is found. Implement a singly linked list of ordered integers (ascending/descending) with insert, search and display operations.
 - Creation of singly linked list in sorted order [10]
 - Search, Display operation carries 4 marks each [8]
 - Insert operation [7]

OR

Q.1) Data Structures Using 'C'

1. Suppose that we are selling the services of a machine. Each user pays a fixed Amount per use. However the time needed by each user is different. We wish to maximize the returns from this machine under the assumption that the machine is not to be kept idle unless no user is available. Whenever the machine becomes available, the user with the smallest time requirement is selected. When a new user requests the machine, he has to wait if there are pending requests. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q.2) Object Oriented Programming Using C++

[Total Marks 30]

1. Define a class Message with two data members one character pointer and an integer storing length. Implement following functions:
 - a) Default constructor and Parameterized constructor [2+3]
 - b) Overload binary + operator to represent concatenation of messages [7]
 - c) Overload [] operator to return a character at a specific position [8]
 - d) Overload = operator to copy one Message object to another. [5]
 Write a main function that uses the above class and its member functions. [5]

OR

2. A book(ISBN) and CD(data capacity) are both types of media(id, title) objects. A person buys 10 media items, each of which can be either book or CD. Display the list of all books and CD's bought. Define the classes and appropriate member functions to accept and display data. Use pointers and concepts of polymorphism (virtual functions).
 - Accept and display for class media, book and CD - each function carries 2 marks [12]
 - Use of polymorphism(virtual function) [8]
 - main function with use of pointers and display list of all books and CD's. [10]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'

[Total Marks 40]

1. Read the data from the file "employee.txt" and sort on age using insertion sort.
 - Reading & Display the file [10]
 - Insertion sort Function [5]
2. Write a C program that accepts a directed graph as an adjacency matrix and converts it to adjacency list representation. Implement functions to print out degree of any vertex i (take i as parameter to the function) from adjacency list
 - Read a graph as adjacency Matrix [5]
 - Creation of adjacency List & Display [7+3]
 - Calculate out degree of any vertex i [10]

OR

Q.1) Data Structures Using 'C'

1. An Infix expression of the form $a*(b+c)*((d-a)/b)$ need to be converted to postfix form using usual precedence of operators. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Implement a class Message having two data members a pointer to character and an integer storing length of the string. Implement a class Key having two data members a character array of size 30 and an integer storing actual length of the string. The restrictions on Key are that the length should be less than 30 but minimum size 8 and having atleast one digit and one upper case character in it. Write a friend function to encrypt a Message using key (use some encryption algorithm) and decrypt the encrypted text and display it.

- Accept and Display function for Message & Key class –each carries 5 marks [10]
- Friend function to encrypt the message using encryption algorithm and display encrypted text. [10]
- Decrypt the encrypted text and display it. [5]
- Write a main function that uses the above class and its member functions. [5]

OR

2. Implement a class 'printdata' to overload 'print' function as follows:

- a) void print(int) - outputs value - <int>, that is, value followed by the value of the integer.
eg. print(10) outputs value -<10> [5]
 - b) void print (int, int) – outputs value – [<int>, <int>], that is, value followed by the two integers separated by comma in square brackets.
eg print(4,6) outputs value-<4>,<6> [5]
 - c) void print(char *) – outputs value –"char*", that is, value followed by the string in double quotes. eg print("hi") outputs value-"hi" [5]
 - d) void print(int n, char *)- display first n characters from the given string.
eg print(3,"Object")- outputs value –"Obj" [5]
 - e) void print(char ch, char *)- count occurrences of a character from the given string.
eg print('P',"CPP Programming")- outputs value –3 [5]
- Write a main function that uses the above class and its member functions. [5]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'

[Total Marks 40]

1. Read the data from the file "employee.txt" and sort on age using Bubble sort.
 - Reading the contents of File & Display Function [10]
 - Bubble sort Function [5]
2. Write a C program that accepts the graph as an adjacency matrix and converts it to adjacency list representation. Implement functions to print out degree of any vertex i (take i as parameter to the function) from adjacency list
 - Read a graph as adjacency Matrix [5]
 - Creation of adjacency List [10]
 - Calculate out degree of any vertex i [10]

OR

Q.1) Data Structures Using 'C'

1. Suppose that we are selling the services of a machine. Each user uses the machine for a fixed amount of time. However the people are ready to pay different amounts for the service. We wish to maximize the returns from this machine under the assumption that the machine is not to be kept idle unless no user is available. Whenever the machine becomes available, the user with the highest paying amount is selected. When a new user requests the machine, he has to wait if there are pending requests. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Implement the following class hierarchy:
 - Student: id, name,
 - StudentExam (derived from Student): with n subjects (n can be variable)
 - StudentResult (derived from StudentExam): with percentage, gradeDefine a parameterized constructor for each class and appropriate functions to accept and display details. Create n objects of the StudentResult class and display the marklist using suitable manipulators.
 - Parameterized constructor, accept and display for each class-each function carries 2 marks [18]
 - Display marklist with Use of manipulators [7]Write main function that uses the above class and its member functions. [5]

OR

2. Define a class named Clock with three integer data members for hours, minutes and seconds. Define parameterized and default constructors. Overload increment and decrement operators appropriately. Overload extraction and insertion operators. Write appropriate display function. Consider 24 hr format.
 - Default constructor and Parameterized constructor [2+3]
 - Overloading of each operator carries 5 marks [20]
 - Display Function [2]Write a main function that uses the above class and its member functions. [3]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'

[Total Marks 40]

1. Read the data from the file "employee.txt" and sort on names in alphabetical order (use strcmp) using bubble sort
 - Reading the contents of File & Display Function [10]
 - Bubble sort Function [5]
2. Write a C program that accepts a directed graph as an adjacency matrix and converts it to adjacency list representation. Write a function to display the graph in adjacency list form.
 - Read a graph as adjacency Matrix [5]
 - Creation of adjacency List [10]
 - Display adjacency List & out degree of any vertex i (take i as parameter to the function) each carries 5 marks [10]

OR

Q.1) Data Structures Using 'C'

1. A factory has many machines and many jobs that require processing on some of the machines. Each job has a job card which contains all the attributes of a job including the machines on which it needs to be processed and the processing time. For simplicity let us assume that there are ten machines numbered 0,1, 2...9, each job is processed for fixed amount of time and the job card number is coded in such a way that the machine requirements can be accessed. For example if job card number is 5438, it means job requires processing on machines 5, 4, 3 and 8. The job can be processed simultaneously on these machines. However each machine can process jobs one at a time and takes up the new job when it becomes idle. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms

Q 2) Object Oriented Concepts and Programming in C++:

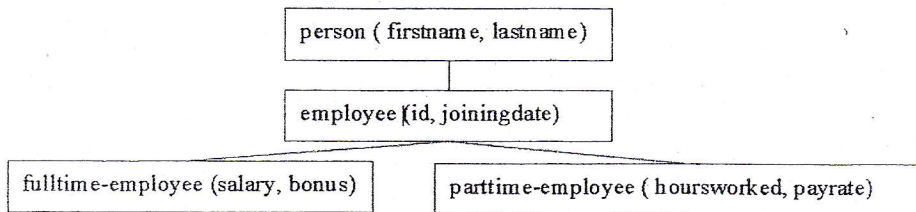
[Total Marks 30]

1. Define a class named Complex for representing complex numbers. A complex number has the general form $a + ib$, where a - the real part, b - the imaginary part are both real numbers and $i^2 = -1$. Define parameterized and default constructor. Overload +, - and * operators with usual meaning.
 - Default constructor & Parameterized constructor-each carries 3 marks [6]
 - Overloading of + operator & - operator- each carries 5 marks [10]
 - Overloading of * operator [9]

Write a main function that uses the above class and its member functions. [5]

OR

2. Given the following inheritance hierarchy, implement each of the classes.



The person class has parameterized constructor, accept and display functions. The employee id is auto generated from the last allotted value stored in employee class. Write constructors, accept and display functions for derived classes. Define member function compute pay for employee and override appropriately in derived class. Write main program to illustrate use of the classes

- Parameterized constructor, accept and display for each class carries -(2+1+1) marks [16]
- Compute pay() for employee [1]
- Overriding of compute pay() in derived classes-function in each class carries 4marks [8]

Write a main function that uses the above class and its member functions. [5]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'

[Total Marks 40]

1. Read the data from the file "employee.txt" and sort on names in alphabetical order (use strcmp) using Insertion sort

- Reading the contents of File & Display Function [10]
- Insertion sort Function [5]

2. Write a C program that accepts the graph as an adjacency matrix and checks if the graph is undirected. The matrix for undirected graph is symmetric. Also calculate in degree of all vertices

- Read a graph as adjacency Matrix [5]
- Check the matrix is symmetric or not [10]
- Calculate in degree of all vertices [10]

OR

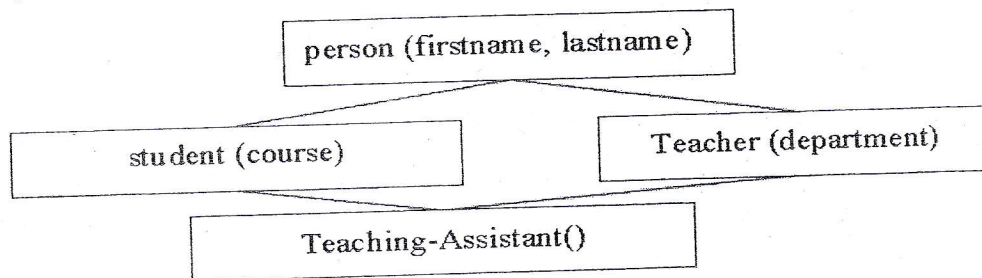
Q.1) Data Structures Using 'C'

1. A file manager identifies each file using an inode-no. A directory is also a file identified by an inode-no. Directory is a list of files each represented by an inode-no. The list has the header containing the inode-no of the parent that is the directory itself. A separate table indexed by inode-no maintains attributes of files including the name of the file. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Implement the following class hierarchy



Define constructors and appropriate functions to accept and display details.

- Parameterized constructor, accept and display for each class carries-(2+2+2) marks [24]
- Write main function to accept details of 'n' Teaching-Assistants and display the details. [6]

OR

2. Implement a class "file" with four data members, a string storing the name of the file and integers storing the number of characters, words and lines in the file. Write the following member functions:

- a) The constructor takes only the file name as the argument and opens the file, counts the characters, words and lines and initializes the other data members. [8]
- If the file does not exist creates a blank file with the name and other data members are initialized to zero. [5]
- b) member functions that count number of blank lines [6]
- c) searches for occurrence of word in the file [6]
- Write main function that uses the above class and its member functions. [5]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'

[Total 40 Marks]

1. Sort a random array of n integers (accept the value of n from user) in ascending order by using a recursive Merge sort algorithm.
 - Accept & Display Function [8]
 - Merge Sort Function [7]
2. Write a C program which uses Binary search tree library and implements following Functions
 - Create Binary search Tree [10]
 - Search a node in binary search tree [10]
 - Display a binary search tree(Pre- Order Traversal) [5]

OR

Q.1) Data Structures Using 'C'

1. Polynomials with varying degree can be represented using linked list. A term in a polynomial is represented by a node with structure.

Coefficient exponent Link

For example a polynomial $x^{1000} + 3x^{50} + 5x^4$ can be represented as

Header 1 1000 3 50 5 4

The number of nodes required to represent the polynomial is same as the number of terms in the polynomial with an additional node for the header. The nodes are maintained in the descending order of exponents. One need to accept, display polynomial and also perform other operation on polynomials such as addition. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Write the definition for a class called 'time' that has hours, minutes & seconds as integer data members. Consider 24 hr format. The class has the following member functions:
 - a) void settime(int, int, int) to set the specified values of hours, minutes and seconds in object. [5]
 - b) void showtime() to display contents of time object. [5]
 - c) time add(time) add the corresponding values of hours, minutes and seconds (<60) in time object argument to current time object and make appropriate conversions and return time. [8]
 - d) time diff(time) subtract values of hours, minutes and seconds in time object argument from current time object after making appropriate conversions and return time difference. [8]

Write a main program to illustrate the use of above class and member function. [4]

OR

2. Write the definition for a class called Rectangle that has floating point data Members length and width. The class has the following member functions:
 - a) void setlength(float) to set the length of data member [2]
 - b) void setwidth(float) to set the width of data member [2]
 - c) float perimeter() to calculate and return the perimeter of the rectangle [2]
 - d) float area() to calculate and return the area of the rectangle [2]
 - e) void show() to display the length and width of the rectangle [2]
 - f) Overload compare() to
 - compare two rectangles by length and width [7]
 - compare two rectangles by area [8]

Write main function to create two rectangle objects and display each rectangle and its area and perimeter [5]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'**[Total Marks 40]**

1. Sort a random array of n integers (accept the value of n from user) in ascending order by using recursive Quick sort algorithm.

- Accept & Display Function [8]
- Quick Sort Function [7]

2. Write a C program which uses Binary search tree library and implements following Functions (use Recursion).

- Create Binary search Tree [10]
- Count all leaf nodes in Binary search tree [10]
- Post order Traversal [5]

OR**Q.1) Data Structures Using 'C'**

1. The Josephus problem is the following game. N people, numbered 1 to N are sitting in a circle. Starting at person 1, a hot potato is passed, After M passes, the person holding the hot potato is eliminated, the circle closes ranks, and the game continues with the person who was sitting after the eliminated person picking up the hot potato. The last remaining person wins. Thus, If M=0 and N=5, players are eliminated in order, and player 5 wins. If M=1 and N=5, the order of elimination is 2, 4, 1, 5 and the player 3 wins. The Josephus problem needs to be solved for general values of M and N ($N > 10000$). Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:**[Total Marks 30]**

1. Define a class named Clock with three integer data members for hours, minutes and seconds. Define parameterized and default constructors. Overload increment and decrement operators appropriately. Overload extraction and insertion operators. Consider 24 hr format.

- Default constructor and Parameterized constructor [2+3]
- Overloading of each operator carries 5 marks [20]
- Disply Function [2]

Write a main function that uses the above class and its member functions. [3]

OR

2. Write the definition for a class called Rectangle that has floating point data Members length and width. The class has the following member functions:

- a) void setlength(float) to set the length of data member [2]
- b) void setwidth(float) to set the width of data member [2]
- c) float perimeter() to calculate and return the perimeter of the rectangle [2]
- d) float area() to calculate and return the area of the rectangle [2]
- e) void show() to display the length and width of the rectangle [2]
- f) Overload compare() to
 - compare two rectangles by length and width [7]
 - compare two rectangles by area [8]

Write main function to create two rectangle objects and display each rectangle and its area and perimeter. [5]

Q.3) Viva**[10]**

[Total Marks 40]

1. Read the data from the 'employee.txt' file and sort on age using Merge sort and write the sorted data to another file 'sortedemponage.txt'.
 - Reading & Display the file [10]
 - Merge sort Function [5]
2. Write a C program which uses Binary search tree library and implements following Functions
 - Create Binary search Tree [10]
 - In order Traversal [5]
 - Search a node in binary search tree [5]
 - Count all nodes in binary search tree [5]

OR

Q.1) Data Structures Using 'C'

1. Consider the database of books maintained in a library system. When a user wants to check whether a particular book is available, a search operation is called for. If the book is available and is issued to the user, a delete operation can be performed to remove this book from the set of available books. When the user returns the book, it can be inserted back into the set of available books. It is essential that we are able to support the above mentioned operations as efficiently as possible as since these operations are performed quite frequently. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Implement a class 'data' to overload following functions as follows:
 - a) int maximum(int, int) – returns the maximum between the two integer arguments [2]
 - b) int maximum(int *a, int arraylength) – returns the maximum integer from an array 'a' [5]
 - c) void maximum(int *a, int arraylength, int n) – display all elements from the array 'a' which are greater than given number 'n'. [5]
 - d) int minimum(int, int) – returns the minimum between the two integer arguments [2]
 - e) int minimum(int *, int arraylength) – returns the minimum integer from an array 'a' [5]
 - f) void minimum(int *a, int arraylength, int n) – display all elements from the array 'a' which are smaller than given number 'n'. [5]

Write a main function that uses the above class and its member functions. [6]

OR

2. A book(ISBN) and CD(data capacity) are both types of media(id, title) objects. A person buys 10 media items, each of which can be either book or CD. Display the list of all books and CD's bought. Define the classes and appropriate member functions to accept and display data. Use pointers and concepts of polymorphism (virtual functions).
 - Accept and display for class media, book and CD - each function carries 2 marks [12]
 - Use of polymorphism(virtual function) [8]
 - main function with use of pointers and display list of all books and CD's. [10]

Q.3) Viva

[10]

[Total Marks 40]

1. Read the data from the 'employee.txt' file and sort on age using Quick sort and write the sorted data to another file 'sortedemponage.txt'.
 - Reading & Display the file [10]
 - Quick sort Function [5]
2. Write a C program which uses Binary search tree library and implements following Functions
 - Create Binary search Tree [10]
 - Search a node in binary search tree [10]
 - Display a binary search tree (In order Traversal) [5]

OR

Q.1) Data Structures Using 'C'

1. An Address book contains the name and other details of friends. User wants to check for a particular name and get the details such as phone number or email address of his friend. New Addresses are added to the address book. The contact information may also require frequent updation. Certain important contact numbers (a small number) which are frequently required should be accessible very fast. These contacts may be important (favourites) at some point in time but may not continue to remain so and have to be removed. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Implement a class 'invertdata' to overload 'invert' function as follows:
 - a) int invert (int) - returns the inverted integer. Eg. invert(5438) will return 8345 [10]
 - b) char * invert (char *) - returns the reversed string - reverse("comp") will return "pmoc" [8]
 - c) void invert(int *) - will reverse the array order - An array [5, 7, 12, 4] will be inverted to [4, 12, 7, 5]. [7]Write a main function that uses the above class and its member functions. [5]

OR

2. Implement the following class hierarchy:
 - Student: id, name,
 - StudentExam (derived from Student): with n subjects (n can be variable)
 - StudentResult (derived from StudentExam): with percentage, gradeDefine a parameterized constructor for each class and appropriate functions to accept and display details. Create n objects of the StudentResult class and display the marklist using suitable manipulators.
 - Parameterized constructor, accept and display for each class-each function carries 2 marks [18]
 - Display marklist with Use of manipulators [7]Write main function that uses the above class and its member functions. [5]

Q.3) Viva

[10]

1. Create a random array of n integers. Accept a value x from user and use linear search algorithm to check whether the number is present in the array or not and output the position if the number is present.
 - Accept & Display Function [8]
 - Linear Search Function [7]
2. Implement a stack library (dystack.h) of integers using a dynamic (linked list) implementation of the stack and implementing the Push,Pop,IsEmpty,Init,Peek operations. Write a menu driven program that includes stack library and calls different stack operations.
 - Push & Pop operation carries 8 mark each [16]
 - Isempty & Peek carries 4 mark each [8]
 - Init [1]

OR

Q.1) Data Structures Using 'C'

1. In breadth first search (BFS) of a Graph we start at vertex v and mark it as having been visited. All unvisited vertices adjacent from v are visited next. The v is thus completely explored. The visited but unexplored vertices are taken up next for exploration. Exploration continues until no unexplored vertex is left. If BFS is used on a connected undirected graph G, then all vertices in G get visited and the graph is completely traversed. Thus BFS can be used to check whether graph is connected. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Implement the following class hierarchy:
 Student: id, name,
 StudentExam (derived from Student): with n subjects (n can be variable)
 StudentResult (derived from StudentExam): with percentage, grade
 Define a parameterized constructor for each class and appropriate functions to accept and display details. Create n objects of the StudentResult class and display the marklist using suitable manipulators.
 - Parameterized constructor, accept and display for each class-each function carries 2 marks [18]
 - Display marklist with Use of manipulators [7]
 Write main function that uses the above class and its member functions. [5]

OR

2. Write a C++ program to implement the following:

Define a class 'city' with data members name and STD code. Accept 'n' cities with STD codes from user. Store this data in the file 'cities.txt'. Write a program that reads the data from file cities.txt into the array. Output the list of city with STD codes. Write a search function to search a city by name and display its STD code.

- accept and display function definition-each carries 2 marks [4]
 - writing data to a file and reading data from a file-each carries 5 marks [10]
 - Display list of cities with STD codes from file [5]
 - Search function [6]
- Write main function that uses the above class and its member functions. [5]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'

[Total Marks 40]

1. Read the data from file 'cities.txt' containing names of 10 cities and their STD codes. Accept a name of the city from user and use linear search algorithm to check whether the name is present in the file and output the STD code, otherwise output "city not in the list".

- Accept & Display Function [8]
- Linear Search Function [7]

2. There are lists where new elements are always appended at the end of the list. The list can be implemented as a circular list with the external pointer pointing to the last element of the list. Implement singly linked circular list of integers with append and display operations. The operation append(L, n), appends to the end of the list, n integers either accepted from user or randomly generated

- Creation of circular Link List & Append Function each carries 10 marks [20]
- Display Function [5]

OR

Q.1) Data Structures Using 'C'

1. In depth first search of a Graph we start at vertex v and mark it as having been visited. The exploration of the vertex involves visiting all the adjacent vertices however the exploration of a vertex is suspended as soon as a new vertex is reached and the exploration of a new vertex begins. When the exploration of new vertex is over, the exploration v is resumed. DFS can be best implemented as a recursive function. A topological sort of a directed acyclic graph is a linear ordering of all its vertices such that if G contains an edge (u, v), then u appears before v in the ordering. For topological ordering DFS is called on the graph and every vertex explored is added onto the front of a linked list that forms the topological order. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms

Q.2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Write the definition for a class called "cuboidSolid" that has length, breadth, height and mass has float data members. The class has the following member functions.

- a) Accept() and Display() functions – each carries 5marks [10]
 - b) float getVolume() that returns the volume of the metal [5]
 - c) float getSurfaceArea() that returns the surface area [5]
 - d) float getDensity() that returns the density [5]
- Write a main program to illustrate the use of above class and member function. [5]

OR

2. Define a class account with following specifications :

private data members : **account number** – automatically generated six digit account number, first two digit are used for bank code (assume the value 82) and next four digits for

{**account number**(use static keyword), **account type** – it can be one of the following type { saving, current, fixed, recurring}, **amount** – long integer for the balance amount, **Owner**

Name – name of the owner

Public data members:

- a) Accept () with valid account number and Use of static keyword [7]
- Accept() with validation for account type [3]
- Other data members [2]
- b) Display account information [5]
- c) Deposit an amount in an account [2]
- d) Withdraw an amount after checking the minimum balance condition [3]

Write a main program to accept information from user and open 'n' accounts

(Use dynamical memory allocation) and display their information. [8]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'

[Total Marks 40]

1. Read the data from file 'sortedcities.txt' containing names of 10 cities and their STD codes. Accept a name of the city from user and use binary search algorithm to check whether the name is present in the file and output the STD code, otherwise output "city not in the list".
 - Accept & Display Function [8]
 - Binary Search Function [7]

2. Implement a list library (singlylist.h) for a singly linked list of characters with the insert, delete, search, display operations. Write a menu driven program to call the operations.
 - Creation of Singly link list [4]
 - Insert, Delete carries 6 marks each [12]
 - Display Function [4]
 - Search Function [5]

OR

Q.1) Data Structures Using 'C'

1. A postfix expression of the form $ab+cd-*ab/$ is to be evaluated after accepting the values of a, b, c and d. The value should be accepted only once and the same value is to be used for repeated occurrence of same symbol in the expression. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Implement a class 'invertdata' to overload 'invert' function as follows:
 - a) int invert (int) - returns the inverted integer. eg. invert(5438) will return 8345 [10]
 - b) char * invert (char *) - returns the reversed string - eg. reverse("comp") will return "pmoc" [8]
 - c) void invert(int *) - will reverse the array order - An array [5, 7, 12, 4] will be inverted to [4, 12, 7, 5]. [7]

Write a main function that uses the above class and its member functions. [5]

OR

2. Define a class named Clock with three integer data members for hours, minutes and seconds. Define parameterized and default constructors. Overload increment and decrement operators appropriately. Overload extraction and insertion operators. Consider 24 hr format.
 - Default constructor and Parameterized constructor [2+3]
 - Overloading of each operator carries 5 marks [20]

Write a main function that uses the above class and its member functions. [5]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'

[Total Marks 40]

1. Implement a stack library (ststack.h) of integers using a static implementation of the stack and implementing the Init(), Push(), Pop(), IsEmpty() & IsFull() these operations. Write a Menu driven program that includes stack library and calls different stack operations
 - Push & Pop Function each carries 5 Marks [10]
 - Init Function [1]
 - IsEmpty Function & IsFull Function each carries 2 marks [4]
2. Implement a list library (doublylist.h) for a doubly linked list of integer with the insert, delete search, display operations. Write a menu driven program to call the operations.
 - Creation and Display of doubly link list each carries 4 marks [8]
 - Insert, Delete carries 6 marks each [12]
 - Search Function [5]

OR

Q.1) Data Structures Using 'C'

1. Banks often record transactions on an account, in order of the times of the transactions, but many people like to receive their bank statements with cheques listed in order by cheque number. People usually write (use) cheques in order by cheque number, and merchants usually cash them with reasonable dispatch. Thus few cheque numbers are usually out of order. Use an appropriate sorting algorithm for converting time of transaction ordering to cheque number ordering. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Implement a class 'printdata' to overload 'print' function as follows:
 - a) void print(int) - outputs value - <int>, that is, value followed by the value of the integer. eg. print(10) outputs value -<10> [5]
 - b) void print (int, int) - outputs value - [<int>, <int>], that is, value followed by the two integers separated by comma in square brackets. eg print(4,6) outputs value- [<4>, <6>] [5]
 - c) void print(char *) - outputs value - "char*", that is, value followed by the string in double quotes. eg print("hi") outputs value-"hi" [5]
 - d) void print(int n, char *)- display first n characters from the given string. eg print(3,"Object")- outputs value -"Obj" [5]
 - e) void print(char ch, char *)- count occurrences of a character from the given string. eg print('P',"CPP Programming")- outputs value -3 [5]
- Write a main function that uses the above class and its member functions. [5]

OR

2. Implement a class Time12 which stores time in 12 hr format (hh, mm, ss, am/pm). It has four data members, three integers for hour, minutes and seconds and a character array of size 2 storing am/pm. Define constructor with default arguments (midnight). Define accept and display functions. Implement a second class Time24 which stores time in 24 hr format (hh, mm, ss). It has three data members, three integers for hours, minute & seconds. Implement following functions:
 - a) Friend function isequal() to compare time in 12 hr format to time in 24 hr format [8]
 - b) convert time in 12 hr format to 24 hr format [6]
 - constructor of class Time12 with default argument [5]
 - Accept & display Function [5]
- Write a main function that uses the above class and its member functions. [6]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'

[Total Marks 40]

1. Create a random array of n integers. Accept a value x from user and use linear search algorithm to check whether the number is present in the array or not and output the position if the number is present.
 - Accept & Display Function [8]
 - Linear Search Function [7]
2. Implement a stack library (dystack.h) of integers using a dynamic (linked list) implementation of the stack and implementing the init, push, pop, peek & isempty operations. Write a menu driven program that includes stack library and calls different stack operations.
 - Push & Pop operation carries 8 marks each [16]
 - Init [1]
 - Peek & Is empty operation carries 4 marks each [8]

OR

Q.1) Data Structures Using 'C'

1. In breadth first search (BFS) of a Graph we start at vertex v and mark it as having been visited. All unvisited vertices adjacent from v are visited next. The v is thus completely explored. The visited but unexplored vertices are taken up next for exploration. Exploration continues until no unexplored vertex is left. If BFS is used on a connected undirected graph G, then all vertices in G get visited and the graph is completely traversed. Thus BFS can be used to check whether graph is connected. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Write a C++ program to implement the following:

Define a class 'city' with data members name and STD code. Accept 'n' cities with STD codes from user. Store this data in the file 'cities.txt'. Write a program that reads the data from file cities.txt into the array. Output the list of city with STD codes. Write a search function to search a city by name and display its STD code.

 - Accept and display function definition-each carries 2 marks [4]
 - Writing data to a file and reading data from a file-each carries 5 marks [10]
 - Display list of cities with STD codes from file [5]
 - Search function [6]

Write main function that uses the above class and its member functions. [5]

OR

2. Define a class named Complex for representing complex numbers. A complex number has the general form $a + ib$, where a- the real part, b - the imaginary part are both real numbers and $i^2 = -1$. Define parameterized and default constructor. Overload +, - and * operators with usual meaning.
 - Default constructor & Parameterized constructor-each carries 3 marks [6]
 - Overloading of + operator & - operator- each carries 5 marks [10]
 - Overloading of * operator [9]

Write a main function that uses the above class and its member functions. [5]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'

[Total Marks 40]

1. Implement a list library (singlylist.h) for a singly linked list of integer with the operations create, Delete, display. Write a menu driven program to call these operations.
 - Create & Delete at front, Display Operation Carries 5 Marks each. [15]
2. Implement a queue library (dyqueue.h) of integers using a dynamic (circular linked list) implementation of the queue and implementing the above Insert,Delete,Is Empty operations. Write a menu driven program that includes queue library and calls different queue operations.
 - Insert,Delete,Create ,IsEmpty,Display operation carries 5 marks each [25]

OR

Q.1) Data Structures Using 'C'

1. Given a data set consisting of n integers, a five point summary is to be produced consisting of Minimum, Maximum, Median, 1st and 3rd Quantile. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

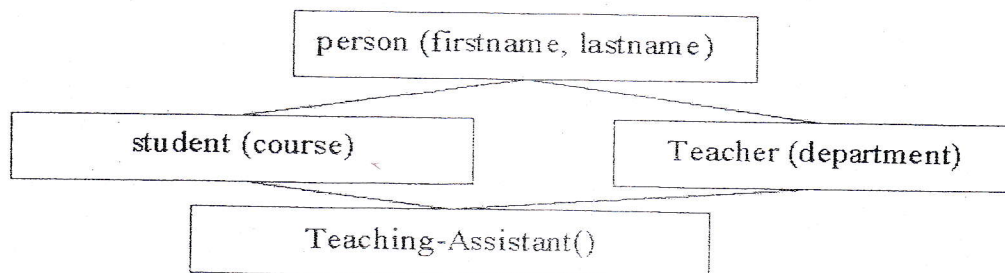
Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Implement a class Message having two data members a pointer to character and an integer storing length of the string. Implement a class Key having two data members a character array of size 30 and an integer storing actual length of the string. The restrictions on Key are that the length should be less than 30 but minimum size 8 and having atleast one digit and one upper case character in it. Write a friend function to encrypt a Message using key (use some encryption algorithm) and decrypt the encrypted text and display it.
 - Accept and Display function for Message & Key class –each carries 5 marks [10]
 - Friend function to encrypt the message using encryption algorithm and display encrypted text. [10]
 - Decrypt the encrypted text and display it. [5]
 - Write a main function that uses the above class and its member functions. [5]

OR

2. Implement the following class hierarchy



- Define constructors and appropriate functions to accept and display details.
- Parameterized constructor, accept and display for each class carries-(2+2+2) marks [24]
- Write main function to accept details of 'n' Teaching-Assistants and display the details. [6]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'

[Total Marks 40]

1. Implement a list library (singlylist.h) for a singly linked list of integers with the operations create, search, display. Write a menu driven driver program to call these operations.
 - Create, Search, Display operation carries 5 each

[15]
2. Write a C program which uses Binary search tree library and implements following Functions
 - Create Binary Search Tree
 - Count non leaf nodes in binary search tree
 - Display a binary search tree (Pre order Traversal)

[10]
[10]
[5]

OR

Q.1) Data Structures Using 'C'

1. A spell checker is a program that looks at a document and compares each word in the document to words stored in a dictionary. If it finds words in the dictionary, it moves on to the next word, If it does not find the word, it reports the user about the misspelled (possibly) word. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Write the definition for a class called 'time' that has hours, minutes & seconds as integer data members. Consider 24 hr format. The class has the following member functions:
 - a) void settime(int, int, int) to set the specified values of hours, minutes and seconds in object.
 - b) void showtime() to display contents of time object.
 - c) time add(time) add the corresponding values of hours, minutes and seconds (<60) in time object argument to current time object and make appropriate conversions and return time.
 - d) time diff(time) subtract values of hours, minutes and seconds in time object argument from current time object after making appropriate conversions and return time difference.

Write a main program to illustrate the use of above class and member function.

[5]
[5]
[8]
[8]
[4]

OR

2. Write the definition for a class called Rectangle that has floating point data Members length and width. The class has the following member functions:
 - a) void setlength(float) to set the length of data member
 - b) void setwidth(float) to set the width of data member
 - c) float perimeter() to calculate and return the perimeter of the rectangle
 - d) float area() to calculate and return the area of the rectangle
 - e) void show() to display the length and width of the rectangle
 - f) Overload compare() to- compare two rectangles by length and width
-compare two rectangles by area

Write main function to create two rectangle objects and display each rectangle and its area and perimeter.

[2]
[2]
[2]
[2]
[7]
[8]
[5]

Q.3) Viva

[10]

1. Implement a list library (doublylis.h) for a doubly linked list of integers with create, Insert & display operations. Write a menu driven program to call these operations.
 - Create Insert at end, Display carries 5 mark each [15]
2. Implement a queue library (stqueue.h) of integers using a static implementation of the queue and implementing the Insert, Delete, IsEmpty, IsFull, Init, Peek operations. Write a Menu driven program that includes queue library and calls different queue operations.
 - Insert, Delete operation carries 8 mark each [16]
 - IsEmpty, IsFull function carries 3 mark each [6]
 - Init, Peek function [3]

OR

Q.1) Data Structures Using 'C'

1. A spell checker is a program that looks at a document and compares each word in the document to words stored in a dictionary. If it finds words in the dictionary, it moves on to the next word, If it does not find the word, it reports the user about the misspelled (possibly) word. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Define a class Message with two data members one character pointer and an integer storing length. Implement following functions:
 - a) Default constructor and Parameterized constructor [2+3]
 - b) Overload binary + operator to represent concatenation of messages [7]
 - c) Overload [] operator to return a character at a specific position [8]
 - d) Overload = operator to copy one Message object to another. [5]
 Write a main function that uses the above class and its member functions. [5]

OR

2. Write the definition for a class called 'time' that has hours, minutes & seconds as integer data members. Consider 24 hr format. The class has the following member functions:
 - a) void setTime(int, int, int) to set the specified values of hours, minutes and seconds in object. [5]
 - b) void showTime() to display contents of time object. [5]
 - c) time add(time) add the corresponding values of hours, minutes and seconds (<60) in time object argument to current time object and make appropriate conversions and return time. [8]
 - d) time diff(time) subtract values of hours, minutes and seconds in time object argument from current time object after making appropriate conversions and return time difference. [8]
 Write a main program to illustrate the use of above class and member function. [4]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'

[Total Marks 40]

1. Implement a list library (doublylis.h) for a doubly linked list of integers with create, Delete & display operations. Write a menu driven program to call these operations.
 - Create ,delete at end , display operation carries 5 mark each [15]
- 2 Write a function that checks whether a string of characters is palindrome or not. The function should use a stack library (cststack.h) of stack of characters using a static implementation of the stack.
 - Push ,Pop operation carries 5 mark each [10]
 - Palindrome function [10]
 - Init,IsEmpty function [5]

OR

Q.1) Data Structures Using 'C'

1. Given a data set consisting of n integers, a five point summary is to be produced consisting of Minimum, Maximum, Median, 1st and 3rd Quantile. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Implement a class Message having two data members a pointer to character and an integer storing length of the string. Implement a class Key having two data members a character array of size 30 and an integer storing actual length of the string. The restrictions on Key are that the length should be less than 30 but minimum size 8 and having atleast one digit and one upper case character in it. Write a friend function to encrypt a Message using key (use some encryption algorithm) and decrypt the encrypted text and display it.
 - Accept and Display function for Message & Key class –each carries 5 marks [10]
 - Friend function to encrypt the message using encryption algorithm and display encrypted text. [10]
 - Decrypt the encrypted text and display it. [5]

Write a main function that uses the above class and its member functions. [5]

OR

2. Define a class named Complex for representing complex numbers. A complex number has the general form $a + ib$, where a- the real part, b - the imaginary part are both real numbers and $i^2 = -1$. Define parameterized and default constructor. Overload +, - and * operators with usual meaning.
 - Default constructor & Parameterized constructor-each carries 3 marks [6]
 - Overloading of + operator & - operator- each carries 5 marks [10]
 - Overloading of * operator [9]

Write a main function that uses the above class and its member functions. [5]

Q.3) Viva

[10]

Data Structures Using 'C'

[Total Marks 40]

1. Implement a list library (doublylis.h) for a doubly linked list of integers with create, search & display operations. Write a menu driven program to call these operations.
 - Create ,search, display operation carries 5 mark each [15]
2. Write a function that reverses a string of characters. The function should use a stack library (cststack.h) of stack of characters using a static implementation of the stack.
 - Push ,Pop operation carries 5 mark each [10]
 - reverses function [10]
 - Init,IsEmpty function [5]

OR

Q.1) Data Structures Using 'C'

1. Banks often record transactions on an account, in order of the times of the transactions, but many people like to receive their bank statements with cheques listed in order by cheque number. People usually write(use) cheques in order by cheque number, and merchants usually cash them with reasonable dispatch. Thus few cheque numbers are usually out of order. Use an appropriate sorting algorithm for converting time of transaction ordering to cheque number ordering. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Define a class 'Fraction' having integer data members numerator and denominator. Define parameterized and default constructors (default values 0 and 1). Parameterized constructor should store the fraction in reduced form after dividing both numerator and denominator by gcd(greatest common divisor). Write a private function member to compute gcd of two integers. Write four member functions for addition, subtraction, multiplication and division of fraction objects. Each function will have two fraction objects as arguments.
 - gcd() function [3]
 - Default constructor and Parameterized constructor [1+4=5]
 - Addition, Subtraction and Division function - each carries 5 marks [15]
 - Multiplication() function [2]Write the main function to illustrate the use of the class and member function. [5]

OR

2. Implement a class vector which contains integers in sorted order. The size of the vector varies so the memory should be dynamically allocated. It should have three data members vectorarray - a pointer to integer, maxsize - the maximum allocated size to take care of insertions and size - actual size. Write member function for:
 - a) Parameterized constructor & copy constructor-each carries 5 marks. [10]
 - b) get value at a particular position in vector [3]
 - c) insert values in vector to keep it in sorted order [5]
 - d) print the vector [2]
 - e) Implement the member functions to form union of two vectors. [5]Write the main function to illustrate the use of the class and member function. [5]
- Q.3) Viva [10]

Q.1) Data Structures Using 'C'

[Total Marks 40]

1. Implement a stack library (ststack.h) of integers using a static implementation of the stack and implementing the Push, Pop, Isempty, IsFull operations. Write a menu driven program that includes stack library and calls different stack operations.
 - Push & Pop operation carries 5 marks each [10]
 - Is Empty [2]
 - Is Full [3]
- 2 Implement a list library (doublylis.h) for a doubly linked list of characters with Create, insert, delete, search & display operations. Write a menu driven program to call these operations.
 - Insert, Delete, create, search, display [6+6+5+4+4]

OR

Q.1) Data Structures Using 'C'

1. In depth first search of a Graph we start at vertex v and mark it as having been visited. The exploration of the vertex involves visiting all the adjacent vertices however the exploration of a vertex is suspended as soon as a new vertex is reached and the exploration of a new vertex begins. When the exploration of new vertex is over, the exploration v is resumed. DFS can be best implemented as a recursive function. A topological sort of a directed acyclic graph is a linear ordering of all its vertices such that if G contains an edge (u, v), then u appears before v in the ordering. For topological ordering DFS is called on the graph and every vertex explored is added onto the front of a linked list that forms the topological order. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Implement a class vector which contains integers in sorted order. The size of the vector varies so the memory should be dynamically allocated. It should have three data members vectorarray – a pointer to integer, maxsize – the maximum allocated size to take care of insertions and size – actual size. Write member function:
 - a) Parametrized constructor & copy constructor-each carries 5 marks [10]
 - b) Set value at a particular position in vector [3]
 - c) To insert values in vector to keep it in sorted order [5]
 - d) Print the vector [2]
 - e) Implement the Write member functions to form intersection of two vectors. [5]
 Write the main function to illustrate the use of the class and member function. [5]

OR

2. Design a class Book with the data members to hold title, number of authors, ISBN number, price and number of copies. The title and ISBN number are pointer to characters. Define following functions:
 - a) parameterized constructor with dynamic memory allocation [8]
 - b) default constructor(number of authors and number of copies equal to 1). [2]
 - c) Copy constructor [4]
 - d) Display() function [3]
 - e) Write a member function to check the validity of the ISBN number; it is a unique 10 digit number assigned to a book. For 10 digit ISBN number, the sum of all the 10 digits, multiplied by its interger weight, descending from 10 to 1, or ascending from 1 to 10, is a multiple of 11. [8]
$$10 \times 1 + 9 \times 2 + 8 \times 3 + 7 \times 4 + 6 \times 5 + 5 \times 6 + 4 \times 7 + 3 \times 8 + 2 \times 9 + 1 \times 10 \equiv 0 \pmod{11}$$
 Call the function in the constructor before initializing the ISBN number.
 Write the main function to illustrate the use of the class and member function. [5]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'

1. Implement a list library (doublylis.h) for a doubly linked list of integers with create, search & display operations. Write a menu driven program to call these operations.

- Create, search, display operation carries 5 mark each [15]

2. Implement a queue library (stqueue.h) of integers using a static implementation of the queue and implementing the insert, delete, isFull, isEmpty, Init, Peek operations. Write a menu driven program that includes queue library and calls different queue operations.

- Insert, Delete operation carries 8 mark each [16]
- IsEmpty, IsFull function carries 3 mark each [6]
- Init, Peek function [3]

OR

Q.1) Data Structures Using 'C'

1. In breadth first search (BFS) of a Graph we start at vertex v and mark it as having been visited. All unvisited vertices adjacent from v are visited next. The v is thus completely explored. The visited but unexplored vertices are taken up next for exploration. Exploration continues until no unexplored vertex is left. If BFS is used on a connected undirected graph G , then all vertices in G get visited and the graph is completely traversed. Thus BFS can be used to check whether graph is connected. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Implement a class 'printdata' to overload 'print' function as follows:

- void print(int) - outputs value - <int>, that is, value followed by the value of the integer. [5]
eg. print(10) outputs value -<10>
- void print (int, int) - outputs value - [<int>, <int>], that is, value followed by the two integers separated by comma in square brackets. [5]
eg print(4,6) outputs value-[<4>,<6>]
- void print(char *) - outputs value - "char*", that is, value followed by the string in double quotes. eg print("hi") outputs value-"hi" [5]
- void print(int n, char *)- display first n characters from the given string. [5]
eg print(3,"Object")- outputs value -"Obj"
- void print(char ch, char *)- count occurrences of a character from the given string. [5]
eg print('P',"CPPProgramming")- outputs value -3 [5]

Write a main function that uses the above class and its member functions.

OR

2. A Matrix has rows and columns which decide the number of elements in the matrix. Implement a matrix class that can handle integer matrices of different dimensions. Overload addition, subtraction and multiplication operator to carry out usual matrix addition, subtraction and multiplication.

- Default constructor & Parameterized constructor [2+3]
- Overloading of + & - operator-each carries 6 marks [12]
- Overloading of * operator [8]

Write a main function that uses the above class and its member functions. [5]

Q.3) Viva

[10]

1. Create a random array of n integers. Accept a value x from user and use linear search algorithm to check whether the number is present in the array or not and output the position if the number is present.
 - Accept & Display Function [8]
 - Linear Search Function [7]
2. Write a C program which uses Binary search tree library and implements following Functions
 - Create Binary Search Tree [10]
 - Search a node in binary search tree [10]
 - Display a binary search tree (Post order Traversal) [5]

OR

Q.1) Data Structures Using 'C'

1. In breadth first search (BFS) of a Graph we start at vertex v and mark it as having been visited. All unvisited vertices adjacent from v are visited next. The v is thus completely explored. The visited but at unexplored vertices are taken up next for exploration. Exploration continues until no unexplored vertex is left. If BFS is used on a connected undirected graph G, then all vertices in G get visited and the graph is completely traversed. Thus BFS can be used to check whether graph is connected. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Design a class Book with the data members to hold title, number of authors, ISBN number, price and number of copies. The title and ISBN number are pointer to characters. Define following functions:
 - a) parameterized constructor with dynamic memory allocation [8]
 - b) default constructor (number of authors and number of copies equal to 1). [2]
 - c) Copy constructor [4]
 - d) Display() function [3]
 - e) Write a member function to check the validity of the ISBN number; it is a unique 13 digit number assigned to a book. For 13 digit ISBN number, the last digit is a check digit which must range from 0 to 9 and sum of all the thirteen digits multiplied by weights alternating between 1 and 3 is a multiple of 10.

$$x_1 + 3x_2 + x_3 + 3x_4 + x_5 + 3x_6 + x_7 + 3x_8 + x_9 + 3x_{10} + x_{11} + 3x_{12} + x_{13} \equiv 0 \pmod{10}$$
 Call the function in the constructor before initializing the ISBN number. [8]
 Write the main function to illustrate the use of the class and member function. [5]

OR

2. Implement a class 'invertdata' to overload 'invert' function as follows:
 - a) int invert (int) - returns the inverted integer. Eg. invert(5438) will return 8345 [10]
 - b) char * invert (char *) - returns the reversed string - reverse("comp") will return "pmoc" [8]
 - c) void invert(int *) - will reverse the array order - An array [5, 7, 12, 4] will be inverted to [4, 12, 7, 5]. [7]
 Write a main function that uses the above class and its member functions. [5]

Q.3) Viva

[10]

Q.1) Data Structures Using 'C'

[Total 40 Marks]

1. Implement a list library (doublylis.h) for a doubly linked list of integers with create, search & display operations. Write a menu driven program to call these operations.
 - Create ,search,display operation carries 5 mark each [15]
2. Write a function that reverses a string of characters. The function should use a stack library (cststack.h) of stack of characters using a static implementation of the stack.
 - Push ,Pop operation carries 5 mark each [10]
 - reverses function [10]
 - Init,IsEmpty function [5]

OR

Q.1) Data Structures Using 'C'

1. Banks often record transactions on an account, in order of the times of the transactions, but many people like to receive their bank statements with cheques listed in order by cheque number. People usually write(use) cheques in order by cheque number, and merchants usually cash them with reasonable dispatch. Thus few cheque numbers are usually out of order. Use an appropriate sorting algorithm for converting time of transaction ordering to cheque number ordering. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Implement a class Time12 which stores time in 12 hr format (hh, mm, ss, am/pm). It has four data members, three integers for hour, minutes and seconds and a character array of size 2 storing am/pm. Define constructor with default arguments (midnight). Define accept and display functions. Implement a second class Time24 which stores time in 24 hr format (hh, mm, ss). It has three data members, three integers for hours, minute & seconds. Implement following functions:
 - a) Friend function isequal() to compare time in 12 hr format to time in 24 hr format [8]
 - b) convert time in 12 hr format to 24 hr format [6]
 - constructor of class Time12 with default argument [5]
 - Accept & display Function [5]
- Write a main function that uses the above class and its member functions. [6]

OR

1. Implement a class 'data' to overload following functions as follows:
 - a) int maximum(int, int) – returns the maximum between the two integer arguments [2]
 - b) int maximum(int *a, int arraylength) – returns the maximum integer from an array 'a' [5]
 - c) void maximum(int *a, int arraylength, int n) – display all elements from the array 'a' which are greater than given number 'n'. [5]
 - d) int minimum(int, int) – returns the minimum between the two integer arguments [2]
 - e) int minimum(int *, int arraylength) – returns the minimum integer from an array 'a' [5]
 - f) void minimum(int *a, int arraylength, int n) –display all elements from the array 'a' which are smaller than given number 'n'. [5]
- Write a main function that uses the above class and its member functions. [6]

Q.3) Viva

[10]

[Total 40 Marks]

display operations. Write a menu driven program to call these operations.

- Create & Delete at in between, Display Operation Carries 5 each Marks. [15]
2. Implement a queue library (stqueue.h) of integers using a static implementation of the queue and implementing the insert,delete,isFull,Isempy,Init,Peek operations. Write a menu driven program that includes queue library and calls different queue operations.
- Insert, Delete operation carries 8 mark each [16]
 - IsEmpty,IsFull function carries 3 mark each [6]
 - Init ,Peek function [3]

OR

Q.1) Data Structures Using 'C'

1. Given a data set consisting of n integers, a five point summary is to be produced consisting of Minimum, Maximum, Median, 1st and 3rd Quantile. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Define a class account with following specifications :

private data members :

- account number – automatically generated six digit account number, first two digit are used for bank code (assume the value 82) and next four digits for account number(use static keyword)
- account type – it can be one of the following type { saving, current, fixed, recurring}
- amount – long integer for the balance amount
- Owner Name – name of the owner

Public data members:

- a) Accept() with valid account number and Use of static keyword [7]
- Accept() with validation for account type [3]
- Other data members [2]
- b) Display account information [5]
- c) Deposit an amount in an account [2]
- d) Withdraw an amount after checking the minimum balance condition [3]

Write a main program to accept information from user and open 'n' accounts (Use dynamical memory allocation) and display their information. [8]

OR

2. Define a class 'Fraction' having integer data members numerator and denominator.

Define parameterized and default constructors (default values 0 and 1). Parameterized constructor should store the fraction in reduced form after dividing both numerator and denominator by gcd(greatest common divisor). Write a private function member to compute gcd of two integers. Write four member functions for addition, subtraction, multiplication and division of fraction objects. Each function will have two fraction objects as arguments. Write the main function to illustrate the use of the class.

- gcd() function [3]
- Default constructor and Parameterized constructor [1+4]
- Addition, Subtraction and Division function - each carries 5 marks [15]
- Multiplication() function [2]

Write the main function to illustrate the use of the class and member function. [5]

Q.3) Viva

[10]

[Total Marks 40]

1. Read the data from the file "employee.txt" and sort on age using insertion sort.

- Reading & Display the file [10]
- Insertion sort Function [5]

2. Implement a list library (doublylist.h) for a doubly linked list of characters with the insert, delete search & display operations. Write a menu driven program to call the operations.

- Insert,delete,create,search,display [6+6+5+4+4]

OR

Q.1) Data Structures Using 'C'

1. In depth first search of a Graph we start at vertex v and mark it as having been visited. The exploration of the vertex involves visiting all the adjacent vertices however the exploration of a vertex is suspended as soon as a new vertex is reached and the exploration of a new vertex begins. When the exploration of new vertex is over, the exploration v is resumed. DFS can be best implemented as a recursive function. A topological sort of a directed acyclic graph is a linear ordering of all its vertices such that if G contains an edge (u, v) , then u appears before v in the ordering. For topological ordering DFS is called on the graph and every vertex explored is added onto the front of a linked list that forms the topological order. Formulate the problem and write a C program to solve the problem by using appropriate data structures and algorithms.

Q 2) Object Oriented Concepts and Programming in C++:

[Total Marks 30]

1. Define a class named Clock with three integer data members for hours, minutes and seconds. Define parameterized and default constructors. Overload increment and decrement operators appropriately. Overload extraction and insertion operators. Consider 24 hour format.

- Default constructor and Parameterized constructor [2+3]
- Overloading of each operator carries 5 marks [20]

Write a main function that uses the above class and its member functions.

[5]

OR

2. Implement a class "file" with four data members, a string storing the name of the file and integers storing the number of characters, words and lines in the file. Write the following member functions:

- a) The constructor takes only the file name as the argument and opens the file, counts the characters, words and lines and initializes the other data members. [8]
If the file does not exist creates a blank file with the name and other data members are initialized to zero. [5]
- b) member functions that count number of blank lines [6]
- c) searches for occurrence of word in the file [6]

Write main function that uses the above class and its member functions.

[5]

Q.3) Viva

[10]